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On-Farm Corn Fertilizer Trials

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Abstract
All cropping systems require fertilizer inputs in order to maintain crop yields. However, excess fertilizer, especially nitrogen and phosphorus, can increase problems with water quality. Starter fertilizer applied with the corn planter has been shown to sometimes increase corn yields. It is important for farmers to use the appropriate rates and methods of fertilizer application to optimize corn yields and minimize the impact on the environment.

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On-Farm Corn Fertilizer Trials

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Introduction

All cropping systems require fertilizer inputs in order to maintain crop yields. However, excess fertilizer, especially nitrogen and phosphorus, can increase problems with water quality. Starter fertilizer applied with the corn planter has been shown to sometimes increase corn yields. It is important for farmers to use the appropriate rates and methods of fertilizer application to optimize corn yields and minimize the impact on the environment.

Materials and Methods

In 2014, seven trials utilizing various methods of fertilizing corn were investigated (Table 1). All trials were conducted on-farm by farmer cooperators using the farmers' equipment. Strips were arranged in a randomized complete block design with at least three replications per treatment. Strip length and width varied from field to field depending on equipment size and size of field. All strips were machine harvested for grain yield.

Trials 1 and 7 investigated the use of 9-18-9 pop-up starter fertilizer on corn yield. In Trial 1, the fertilizer was applied with and without zinc. In Trial 7, the fertilizer was applied with and without Generate. Generate is marketed by AgNition and promoted as a product that generates beneficial microbial activity in the soil and liberates micro and macro nutrients. In both trials, the fertilizer-treated strips were compared with corn planted without starter fertilizer. The soil in Trial 1 tested optimum to high in phosphorus and potassium.

In Trial 2, corn planted with a micronutrient seed treatment was compared with corn planted without the treatment. The treatment was 8 oz/100 lb of seed of Nutriplant SD® marketed by Amway. It contained magnesium, sulfur, copper, iron, manganese, molybdenum, zinc, and calcium.

In Trials 3–6, various rates and application times of nitrogen (N) fertilizer were investigated. Trial 3 investigated a fall application of 220 lb/acre N (as anhydrous ammonia) with and without an additional 50 lb/acre side-dressed (as 32% UAN) on corn at the V10 stage on July 7. Trial 4 compared a split application of N (100 lb/acre at planting followed by 50 lb/acre side-dressed on corn at the V10 stage on July 8) with 150 lb/acre N all at planting. In Trial 5, 4,000 gallons of liquid swine manure fall-applied (containing 192 lb/acre N) was compared with and without an additional 40 lb/acre N (side-dressed as urea on corn at the V8 stage). In Trial 6, a foliar application by air of liquid fertilizer containing 21 lb/acre N and 3 lb/acre P_2O_5 (2 gallons/acre of product) was applied on corn at the V14 stage and compared with strips without the foliar application (which had a total of 180 lb/acre N applied).

Results and Discussion

None of the starter fertilizer treatments in Trials 1 and 7 had any effect on corn yield (Table 2). There was a significant corn yield decrease of 7 bushels/acre with the application of the micronutrient seed treatment in Trial 2. It is not known why the seed treatment would have resulted in a loss of yield. There was not an increase in corn yield with the additional application of 50 lb/acre N side-dressed following the 220 lb/acre of fall applied N in

Trial 3, indicating the 220 lb/acre was adequate or more than adequate for optimum yields in this field in 2014 (Table 2). There was a significant yield decrease of 5 bushels/acre (P = 0.02) with the side-dress application of an additional 40 lb/acre N following a fall application of liquid swine manure in Trial 5 (Table 2). The yield decrease is unusual, but it does indicate the 4,000 gallons of swine manure supplied all of the nitrogen needs of the corn crop.

In Trial 4, there was no advantage to splitting the nitrogen between pre-plant and side-dress, because the two treatments had the same yield. There was a yield increase of 12 bushels/acre with the foliar application of 21 lb/acre N in Trial 6. This field was on corn following corn, so it would not be unusual to get a yield benefit to rates of N greater than the 180 lb/acre applied prior to the foliar application. Weather conditions are important in determining how corn responds to nitrogen rates and application timings, so different results might be seen in other years.

Table 1. Hybrid, row spacing, planting date, planting population, previous crop, and tillage practices from on-farm corn fertilizer trials in 2014.

Exp. no.	Trial	County	Hybrid	Row spacing (in.)	Planting date	Planting population (seeds/A)	Previous crop	Tillage practices
140119	1	Lyon	DeKalb 5378	30	4/21/14	31,500	Soybean	Conventional
140616	2	Cass	Pioneer P993HR	30	5/7/14	34,000	Soybean	No till
140154	3	Plymouth	Pioneer 987	30	4/23/14	35,000	Corn	Conventional
140125	4	Sioux	Pioneer 448AMX	30	5/5/14	34,300	Soybean	Conventional
140103	5	Lyon	Pioneer 297	20	4/25/14	34,600	Corn	Conventional
140304	6	Crawford	Renze 6224	30	5/5/14	29,900	Corn	Spring field cultivate
140208	7	Sac	Golden Harvest 9E98-3000GT	30	5/7/14	30,000	Soybean	No till

Table 2. Yields from on-farm corn fertilizer trials in 2014.

Exp. no.	Trial	Treatment	Yield (bu/A)[x]	P-value[y]
140119	1	Control	203 a	0.72
		1 Gal/A of 9-18-9 starter	206 a	
		1 Gal/A of 9-18-9 + 1 qt/A zinc (9%) starter	206 a	
140616	2	Control	204 a	0.02
		8 oz/100 # of micros with the seed	197 b	
140154	3	220 lb/A N fall applied	185 a	0.25
		220 lb/A N in Fall + 50 lb/A N side-dressed on V10 corn	190 a	
140125	4	150 lb/A N spring preplant	198 a	0.75
		100 lb/A N Spring preplant + 50 lb/A N side-dressed on V10 corn	197 a	
140103	5	4000 Gal/A fall applied swine manure (192 lb/A N)	193 a	0.02
		4000 Gal/A fall applied swine manure followed by 40 lb/A N sidedressed on V8 corn	188 b	
140304	6	Control (180 lb/A N starter+at planting+side-dress)	158 a	0.01
		21+3+0 foliar applied by air on V14 corn on 7/13/14	170 b	
140208	7	Control	219 a	0.85
		5 Gal/A 9-18-9 starter	227 a	
		5 Gal/A 9-18-9 starter + 1 qt/A Generate	216 a	

[x]Values denoted with the same letter within a trial are not statistically different at the significance level of 0.05.
[y]P-Value = the calculated probability that the difference in yields can be attributed to the treatments and not other factors. For example, if a trial has a P-Value of 0.10, then we are 90 percent confident the yield differences are in response to treatments. For P = 0.05, we would be 95 percent confident.